



The value added by government venture capital funds compared with independent venture capital funds

Terttu Luukkonen^{a,*}, Matthias Deschryvere^a, Fabio Bertoni^b

^a The Research Institute of the Finnish Economy, Lönnrotinkatu 4B, 00120 Helsinki, Finland

^b Politecnico di Milano, Piazza Leonardo da Vinci 32, 20133 Milan, Italy

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ABSTRACT

Government venture capital (GVC) funds have been a common policy initiative in European countries to overcome funding gaps in the promotion of early-stage ventures. In this work, we focus on the performance of such government funds. We compare the importance for the firm's development of post-investment, value-added activities by GVC firms and independent venture capital (IVC) firms.

We use a unique data set based on the results of a survey addressed to young high-tech VC-backed firms from seven European countries. The survey gauged the importance of the contribution by the first lead investor in a variety of activity areas, as assessed by the investee companies. Attention was paid to potential adverse effects of the post-investment engagement of investors.

Using a composite indicator of the value added, we find no statistically significant difference between the two types of investors. However, the profiles of value added differ across investor types, and, in particular, the contributions of IVC funds prove to be significantly higher than those of GVC funds in a number of areas, including the development of the business idea, professionalisation and exit orientation.

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1. Introduction

The literature on venture capital (VC) has long acknowledged that, in addition to financial resources, VC investors provide portfolio companies with a complex bundle of value-adding activities (Denis, 2004; Gorman and Sahlman, 1989; Kaplan and Strömberg, 2004; Sapienza, 1992; Sapienza et al., 1996). First, professional investors directly add value to portfolio firms by “coaching”, that is, providing them with financial, administrative, marketing, strategy and management support, which is especially lacking in young, innovative firms operating in high-tech industries. Second, VC fosters the managerial “professionalisation” of young, innovative firms (Bottazzi et al., 2008; Hellmann and Puri, 2002), facilitates access to specialised professional services and establishes alliances with third parties (Colombo et al., 2006; Hsu, 2006; Lindsey, 2008), thus extending their social capital. Moreover, VC can signal the quality of the portfolio firms to third parties such as customers, alliance partners, skilled workers and other financial intermediaries (Stuart et al., 1999).

VC investors, however, differ dramatically in terms of their ability to perform value-adding activities for their portfolio

companies. First, venture capitalists differ in the extent to which they possess human capital, which has implications for their ability to provide high-quality, value-adding services to portfolio firms (Knockaert et al., 2006). Second, the investment motives of venture capitalists differ (Hellmann, 2002), and this will have implications for the amount of time and effort they devote to their portfolio firms. Third, venture capitalists have different investment patterns in terms of the types of firms in which they invest (Siegel et al., 1988), and this will lead to differences in post-investment behaviour; e.g., VCs have been noted to devote more time to early-stage than later-stage portfolio firms (Sapienza et al., 1994) and to add more value to portfolio firms when uncertainty is high (portfolio firms are in the earliest stages and are pursuing innovation strategies compared with those in later stages that are pursuing less innovative strategies (Sapienza et al., 1996). Fourth, the investment horizon varies substantially among different venture capitalists, and this translates into different incentives in providing coaching (e.g., having longer vs. shorter term impact on a firm's performance) (Gompers, 1996).

It is particularly important to distinguish VC investors based on their ownership and governance structures (Da Rin et al., 2011). The most typical form of VC is an independent VC (IVC) fund (Sahlman, 1990). An IVC fund is a limited partnership in which a management company (the general partner) raises capital from limited partners (often institutional investors). The capital is then used to locate selected investment targets, provide

* Corresponding author. Tel.: +358 50 5707789; fax: +358 9 601753.

E-mail addresses: terttu.luukkonen@etia.fi (T. Luukkonen), matthias.deschryvere@vtt.fi (M. Deschryvere), bertoni@em-lyon.com (F. Bertoni).

financial injections and perform post-investment value-adding activities. IVC funds normally have a limited lifespan and have to exit the investment before the fund expires. The management company (the IVC investor) typically runs several funds with different vintages at the same time. Although this is the most common type of VC investor, VC forms other than IVC (collectively known as captive VC) exist and are especially important in Europe (Bottazzi et al., 2008).

In this paper, we will compare the value-adding activities performed by IVC firms with those of a particular form of captive investor: governmental VC (GVC). From a policy perspective, GVC is the most interesting and under-researched type of VC investor. The establishment of GVC funds has been common in many European countries as a part of an effort by governments to fill funding gaps in early stage investments. GVC investors may have varying objectives ranging, for example, from the seeding of the development of a young industry or supporting that industry by providing a credible signal to private investors or supporting regional development and job creation by setting up regional funds (Leleux and Surlemont, 2003). The way in which these overall objectives are translated into investment decisions that affect post-investment behaviour has not been studied thoroughly. In this study, we aim to address this gap in the literature.

Comparing GVC with IVC is particularly useful. First, IVC is the most common type of VC in Europe (Bertoni et al., 2012, estimate that 55.2% of all VC investments in young high-tech companies in Europe between 1994 and 2004 were made by IVC funds). Second because IVC is also the type of VC that is most frequently studied in the literature (Hellmann and Puri, 2002; Higashide and Birley, 2002; Hsu, 2006; Kaplan and Strömberg, 2004; Knockaert et al., 2006; Sapienza et al., 1994, 1996), and thus, most conclusions drawn on the value added and behaviour of VC are based on IVC.

To gauge the extent and composition of value-adding activities, we submitted a survey to young, innovative companies in Europe. A section of the survey questions pertained to the value added by VC investors. The survey data provide us a fine-grained assessment of the importance of the contribution of VC as perceived by its portfolio companies. This allowed us to compare both the overall level and composition of the value added by IVC and GVC firms. Moreover, we were able to study the potential interaction of the value added with the characteristics of the investee company. We compared each dimension of value added between IVC and GVC firms by comparing the level of value added as perceived by respondents from IVC- and GVC-backed companies. We also estimate multivariate regression models in which we control for firm characteristics. Finally, we pay attention to the potential adverse effects that the engagement of VC may cause to the firm (e.g., conflicts with the incumbent management).

The remainder of the paper is organised as follows. In Section 2, we summarise the relevant literature and outline our research hypotheses. In Section 3, we present our sample and methodology. The empirical findings are presented in Section 4. Concluding remarks are provided in Section 5.

2. Related literature and research hypotheses

There are still relatively few studies that directly address the value-adding activities of different types of investors, and the literature is particularly meager with respect to GVC in Europe. Overall, the findings indicate that government funds are less engaged in coaching and value-adding activities for their portfolio firms, which subsequently exhibit worse performance. Knockaert et al. (2006) and Knockaert and Vanacker (forthcoming) found that investment managers of captive funds were less involved in value-adding activities than other investors. Schilder (2006) and

Schäfer and Schilder (2006) noted that GVC firms had limited potential for hands-on activities because they had more portfolio firms per manager, fewer contacts and were less engaged in such activities. Furthermore, Tykvová and Walz (2007) found that firms backed by foreign and reputable IVC investors performed better than firms with other types of VC, especially GVC investors.

There is a growing literature comparing IVC to other forms of captive VC. Chemmanur et al. (2010) studied corporate VC (CVC) and compared its value creation to that of IVC. Their findings indicated that CVC has an important signalling effect, both to IVC firms and to various financial market players, allowing CVC-backed firms to access the equity market at an earlier stage in their lifecycles. Moreover, certification by CVC investors also translates to higher IPO market valuations compared with firms backed by IVC firms alone. Chemmanur et al. (2010) found that CVC investors created value by investing significant resources in younger and riskier firms involving pioneering technologies: because many such firms would not have received external financing from IVC investors, these firms would not have been able to grow and mature without CVC funding. Controlling for selection, however, Bertoni et al. (forthcoming-a) did not find any superior treatment effect of CVC investors on a firm's growth in sales and employees. Instead, they found that IVC investors have a more immediate impact on a firm's growth than CVC investors and interpreted this result as a consequence of the different levels of importance that short-term results have for these two types of investors.

Maula et al. (2005) provided evidence that CVC and IVC investors added value to their portfolio companies in a complementary way. IVC firms are more engaged in enterprise 'nurturing'—helping to raise additional finance, recruiting key employees, and professionalising the organisation—whereas CVC firms excelled in building commercial credibility and capacity and in providing technological support. Tykvová (2006) found that CVC and IVC investors played a more pronounced role in corporate governance than other types of captive VC, including GVC firms.

The findings of these studies are not fully consistent, and there is a tendency to use different classifications or combinations of investors and different categories of value-adding activities. However, the findings seem to indicate that GVC investors tend to be less actively engaged in their portfolio firms than IVC investors. This leads to our first hypothesis concerning GVC and IVC:

Hypothesis 1. The value added by GVC funds to portfolio companies is smaller than that of IVC funds.

On the basis of previous studies, we may also conclude that investor types have differentiated roles in providing non-financial added value to their portfolio firms. Thus, our second hypothesis suggests the following:

Hypothesis 2. The areas of value-adding activities offered by GVC funds differ from those provided by IVC funds.

Some of the different impacts of investor types may be related to their different investment patterns. There is evidence that the degree of involvement by the investor in the portfolio firm varies across portfolio firm characteristics (Fredriksen and Klofsten, 2001; Sapienza and Gupta, 1994; Sapienza et al., 1996): venture capitalists added the most value to companies that were in early stages and highly innovative, and the value added was strongly related to the amount of time devoted to the portfolio company by the venture capitalist. The literature shows that differences exist in the patterns of investment among different types of VC firms (Bertoni et al., 2012), and this could

affect the value-adding behaviour patterns and effects these firms have. There are also studies indicating differences among investors with regard to, for example, the social capital and knowledge resources of the venture capitalist types (Knockaert et al., 2006; Maula et al., 2005).

In our empirical study, we will control for some of the potential interacting factors, namely, the differences in the investment patterns of the investor types or their potential predisposition to invest in particular types of portfolio firms with regard to, for example, the size, stage or other characteristics of the investee firms. Specifically, we aim to control for the selection effect.

Finally, VC investors might also be involved in value-subtracting activities. First, the firm's management and investors often have differences of opinion about a firm's strategy and/or product or innovation activities (Higashide and Birley, 2002), although the impacts of a conflict/disagreement are not merely negative from the point of view of the eventual firm performance but can lead to a corrective action (Higashide and Birley, 2002). Second, VC investments can engender expropriation risk (Ueda, 2004), which could in turn cause an increased cost to protect intellectual property. Accordingly, in this work, we also investigate potential adverse effects and friction from VC involvement with the investee firm and study whether the type of VC investor plays a role in that respect. Our assumption is that active post-investment involvement by the VC investor in the firm can cause friction and other types of adverse effects. However, we do not posit any specific hypotheses but only explore this question.

3. Sample and methodology

3.1. Sample construction

The study is based on a survey administered to a sample of firms retrieved from the VICO database. The VICO dataset was constructed through the joint effort of nine research partners (The nine research partners of the VICO projects are Ecole des Mines de Paris, Politecnico di Milano, Libera Università Carlo Cattaneo, Research Institute of the Finnish Economy, Centre for European Economic Research, Universidad Complutense de Madrid, University College London, Vlerick Leuven Management School, and the University of Gent.) throughout Europe with the support of the 7th European Framework Programme (Grant agreement no. 217485). The objective of the data collection process was to build a large sample of young high-tech companies to provide a comprehensive picture of VC activity in the high-tech sectors of seven European countries: Belgium, Finland, France, Germany, Italy, Spain and the United Kingdom. In this section, we provide a brief description of the sample used in this study; a detailed description of the sampling process used to build the full VICO sample is reported by Bertoni and Martí (2011).

All of the companies contained in our sample were independent at foundation and operate in the following high-tech sectors: pharmaceuticals, ICT manufacturing, robotics, aerospace, telecommunications, internet, software, web publishing, biotech and other R&D services.

Consistent with the objective of this study, all of the companies in our sample received their first round of VC financing when they were less than 10 years old. In so doing, we exclude from the analysis later-stage deals that have markedly different investment objectives and practices from early-stage deals (Bertoni et al., forthcoming-b; Meuleman et al., 2009; Wright et al., 2000). Firms in our sample received their first round of VC financing between 1994 and 2004 and were identified using primary and secondary sources. Identification through secondary

sources was conducted in each country by specialised teams that complemented commercial directories (e.g., Venture Xpert) with local sources (Sources included VC investor websites, local venture capital associations, press releases, press clippings, IPO prospectuses, stock exchange records, Zephyr, the Library House, the ZEW Foundation Panel, VCPro-Database, BVK Directory, the Research on Entrepreneurship in Advanced Technologies directory, Private Equity Monitor, José Martí Pellón's VC Database, and Web Capital Riesgo.). Primary sources included a survey sent to a large group of companies that were asked, among other things, if they had received VC investments. The use of both primary and secondary sources allowed us to have improved coverage of investments pursued by captive investors that tend to be under-represented in commercial directories.

Finally, the population of companies that we use in this study is composed of 803 independent, high-tech, VC-backed companies. For each of these companies, we searched for the email address of a contact person (founder or manager) or, when unavailable, a generic email address for the company.

3.2. Methodology

To assess the value added by different types of investors, we sent a web-based questionnaire to the CEOs of the portfolio companies in early February 2010. Up to four reminders were sent (each an average of 3 weeks after the previous reminder, starting in March 2010). Phone calls were also made at the beginning of May 2010 to raise the response rate. The questionnaire was closed in September 2010.

The survey was conducted using a web-based survey tool (*Lime Survey*). The questionnaires were initially created in English and pre-tested. The questionnaires were translated by local teams participating in the VICO project into the following languages: German, Finnish, French, Italian, and Spanish. In a few cases, when the translation was particularly difficult, we checked its correctness by having it retranslated back into English by local academics not directly involved in the formulation of the questionnaire. The re-translated and original versions were then compared to highlight and correct possible translation errors or language-specific interpretation problems.

The questionnaire sent to the companies asked, among other things, about the perceived effectiveness of value added by the lead investor in the first round of VC financing along various dimensions of activities. We chose to focus on the lead investor in a company because it is the one that is most actively involved in value-adding activities (Elango et al., 1995; Wright and Lockett, 2003). A focus on the first VC investment allows us to avoid the complexity arising from changes in the consortium of VC investors throughout the life of the company (Cumming and Dai, 2010). Moreover, empirical findings indicate that the impact of venture capitalists on firm performance is concentrated in the first few years after the first round of VC financing (Bertoni et al., forthcoming-a; Chemmanur et al., 2010; Croce et al., forthcoming). Thus, the different propensities of IVC and GVC to invest in the first vs. follow-on rounds (as suggested by Bertoni et al., 2012) could lead to biases in the estimates.

Of the 803 companies in the target population, 269 responded to at least part of the questionnaire, corresponding to a response rate of 33.5%. Of the 269 participants who responded to at least one section of the questionnaire, 136 completed the section on value added, which was the most extensive. This corresponds to an overall response rate of 16.9% among those responding to the value added section. The distributions of the population and the full and partial respondents are reported in Table 1.

We performed a number of tests regarding the representativeness of the respondents compared with the initial population.

Table 1
Distribution of VC-backed firms in the population and in the sample of respondents.

Industry	Population		Respondents to any section		Respondents to value added section	
	N	%	N	%	N	%
Biotech, pharma and high-tech	196	24.4	64	23.8	31	22.8
ICT manufacturing and robotics	153	19.1	63	23.4	30	22.1
Telecom, internet and web publishing	182	22.7	40	14.9	20	14.7
Software	272	33.9	102	37.9	55	40.4
Total	803	100	269	100	136	100

Note: In the table, high-tech industry includes the nanotech, energy, other R&D and aerospace sectors. The respondents to any section columns list the firms that started to fill out the survey, while the respondents to the value added section columns list the firms that also filled out the questions on the value added by the VC firms.

We found that the respondents who had worked in the firm since its foundation were the most likely to fill in at least one section of the survey. This increases the credibility of the answers because we can assume that those who were working at the firm at the time of the first investment are better informed about the process than persons who were not working at the firm at that time. However, the groups of firms to which the respondents and non-respondents to the survey belong differ with regard to industry, country and founders' human capital. These differences draw attention to the extent to which our results could be affected by response bias. First, it should be remembered that the objective of our paper is not to measure the value added by VC in itself but to discriminate between IVC and GVC. Accordingly, our results could be biased only if the response bias differs between IVC- and GVC-backed firms. Second, we test the robustness of our results using a multivariate analysis in which the characteristics of the companies are included as control variables. Because our findings are confirmed when these controls are included, we may conclude that differences between IVC and GVC are not driven (only) by response bias. Third, as shown in Table 1, the sectoral distribution of the 136 firms for which information on value added is available is very similar to that of the 269 firms for which, at least, one section of the survey was submitted. Specifically, a χ^2 test does not reject, at customary confidence levels, the null hypothesis that the two distributions are the same ($\chi^2(3)=0.396$, p -value=0.94). The similarity in the sectoral distribution of these two samples suggests that sample selection should not be based on unobservable differences in value added.

The respondents to the section on value added in the questionnaire consist of 66 IVC-backed companies, 22 GVC-backed companies and 48 companies backed by other captive VC investors (bank-affiliated VC, corporate VC or university VC). The small number of observations in each category of captive investors other than GVC does not allow us to compare them with IVC or GVC. We thus focus the analysis only on the 88 companies backed by IVC and GVC.

In line with Manigart et al. (2004), who reported a syndication rate of 28.7% in Europe, syndication does not appear to be common in our sample. From the VICO dataset, we had information about syndication for 70 of the 88 firms. For 71% of this subsample, the first VC investment was not syndicated, i.e., only a single investor was involved. The share of syndicated deals was 34% for IVC and only 12% for GVC. These low shares of syndication during the first round of investment decrease the potential for syndicate partners to influence the findings, thus giving more robustness to our analysis.

4. Empirical findings

4.1. Comparing value-adding contributions of GVC and IVC firms

We measure value added by asking how important the contribution of the lead investor in the first round of financing was for building or developing a number of activity areas within the firm. A scale from 1 (not at all important) to 7 (very important) was used in the survey. Value-adding was examined with respect to 28 activity areas grouped into 8 broader categories: (1) strategy; (2) technology position; (3) market position; (4) professionalisation; (5) financial function; (6) quality; (7) internationalisation and (8) exit orientation (Exit orientation entails measures to encourage the portfolio companies to undertake actions that improve the probability of a successful exit by the investors. Exit is an important part of the venture capital cycle and a prerequisite for VC investors to be inclined to invest (see e.g., Gompers and Lerner (2004)). Exit of the first-stage investors is also important for the portfolio company, enabling it to acquire appropriate funding for later-stage developments.) (see Table 2). The grouping of the activity areas into these 8 categories was verified using factor analysis.

Table 2 presents the total average scores of the value added, the average scores for each of the 8 main categories and 28 more detailed forms of value added by VC type. The aggregate average value added of GVC-supported firms is lower than that of IVC-supported firms, but the difference is not statistically significant. However, significant differences were found across different dimensions of value added.

The lowest average scores for the value-adding activities for both VC types are in internationalisation, although the differences are small. For IVC-supported firms, the highest average is in the professionalisation category (especially for finding board members and reducing changes in the management team), and for GVC-supported firms, it lies in financial functions. GVC-supported firms have lower average scores than IVC-supported firms in 7 of the 8 main categories of value-adding activities, but the scores are significantly different for only two categories: professionalisation and exit orientation. A comparison of the t -test results with those of the non-parametric tests does not reveal large differences.

To summarise, our first hypothesis, namely, that the GVC-supported firms would have lower average value added than the IVC-supported firms, was not supported. The evidence provided support to the second hypothesis in that there were some statistically significant differences in the profiles of the two investor groups. In other words, the difference between IVC and GVC seems to be more about the type rather than the intensity of value added.

4.2. Comparing value-adding contributions while controlling for firm characteristics

As expected, the different types of VC investors differ with respect to the profiles of their investee firms (see Luukkonen et al., 2011, pp. 23–24). There were several statistically significant differences among the average characteristics of the investee firms of the two VC types. To control for the influence of investee firm characteristics (investment profiles), the technological field of the investee firm, and the country where the firm is located, we focused on the relationship between the VC type (GVC and IVC) and the value-adding contributions (VAC) of VC in a multivariate context. Estimating an OLS model while taking data availability into account leaves us with the following specification:

$$\text{VAC of the VC}_{i(2010)}^* = \beta_1(\text{GVC})_{i(1st\ round)} + \beta_2 X_{i(1st\ round)} + \varepsilon_i \quad (1)$$

Table 2
The categories of value added activities of GVC investors versus those of IVC investors^a.

Categories and forms of value-adding	Full sub-sample			GVC firms		IVC firms		Difference Signif.
	Obs	Mean	S.D.	Obs	Mean	Obs	Mean	
TOTAL VALUE-ADDING	79	3.21	0.125	18	2.94	61	3.28	
Strategy	88	3.67	0.168	22	3.39	66	3.77	
Business plan	88	4.01	0.196	22	3.55	66	4.17	
Strategic focus	88	3.67	0.194	22	3.36	66	3.77	
Capabilities	88	3.34	0.191	22	3.27	66	3.36	
Technology position	88	2.89	0.150	22	2.61	66	2.98	
R&D function improvement	88	3.02	0.191	22	2.95	66	3.05	
Strong legal IP base	88	2.81	0.177	22	2.59	66	2.88	
Partnerships for technological development	88	2.84	0.178	22	2.27	66	3.03	*
Market position	88	3.43	0.180	22	3.21	66	3.50	
Sales and marketing position	88	2.89	0.187	22	3.00	66	2.85	
First sales pressure	88	3.49	0.206	22	3.27	66	3.56	
Accelerate growth pressure	88	3.91	0.215	22	3.36	66	4.09	
Professionalisation	88	3.72	0.169	22	3.06	66	3.94	**
Cost base control	88	3.73	0.184	22	3.45	66	3.82	
Corporate governance systems	88	3.86	0.200	22	3.41	66	4.02	
Change in management team	88	3.67	0.206	22	2.73	66	3.98	**
Finding board members	88	3.61	0.206	22	2.64	66	3.94	***
Financial function	86	3.79	0.193	21	3.86	65	3.77	
Obtaining non-equity finance	86	3.69	0.215	21	3.90	65	3.62	
Raising follow-on financing	87	4.01	0.235	21	4.00	66	4.02	
Attracting new VC investors	87	3.71	0.226	21	3.67	66	3.73	
Quality	84	3.74	0.155	20	3.56	64	3.80	
Credibility for other investors	85	4.39	0.191	21	3.90	64	4.55	
Credibility for customers	86	3.52	0.173	21	3.43	65	3.55	
Credibility for suppliers and partners	85	3.52	0.181	20	3.25	65	3.60	
Credibility for recruiting employees	86	3.48	0.188	21	3.29	65	3.54	
Internationalisation	83	2.12	0.152	19	1.96	64	2.17	
Marketing and distribution abroad	85	2.49	0.188	20	2.90	65	2.37	
Seeking equity financing abroad	85	2.19	0.175	21	2.05	64	2.23	
Recruiting management abroad	85	2.04	0.164	21	1.76	64	2.13	
Recruiting other staff abroad	86	1.98	0.150	21	1.76	65	2.05	
Recruiting international board-members	84	1.98	0.156	20	1.55	64	2.11	*
Exit orientation	83	2.90	0.195	20	2.25	63	3.11	**
Prepare IPO	83	2.61	0.215	20	2.15	63	2.76	
Finding acquirers for trade sale	84	2.85	0.202	20	2.00	64	3.11	**
Prepare for other exit routes	84	3.29	0.217	20	2.60	64	3.50	*

^a Each category of value added tabulates the average of all of the forms of value added belonging to that category. Respondents answered 28 questions about the importance of the lead investor for different forms of value added on a scale from 1 (not important at all) to 7 (very important). The first row in the table tabulates the total value-adding contribution, defined as the average of the 28 forms of value added.

* Statistical significance: $p < 0.10$.

** Statistical significance: $p < 0.05$.

*** Statistical significance: $p < 0.01$.

The left-hand side of the above equation contains a measure of VAC. The measure captures the score with which the investees assessed the importance of the value added by their first lead investor. The above equation is run separately for different categories and forms of value added. A first specification of the regression explains the total value added by the first lead investor. A second set of 8 specifications explains the value added contribution by broad categories: (1) strategy; (2) technology position; (3) market position; (4) professionalisation; (5) financial function; (6) quality; (7) internationalisation and (8) exit orientation. To capture all of the available information, a final set of specifications runs separate regressions for 28 detailed forms of VAC.

The first regressor in Eq. (1) captures VC-type: $GVC_{i(1st\ round)}$, equalling 1 if firm i had a government VC as a lead investor during the first round of financing or 0 if the first lead investor was IVC. A set of additional controls is included in the equation. As

performance metrics may vary across industries because of different development pathways and time perspectives, we controlled for industry. To be able to account for the industry dimension in the regressions, single industries had to be grouped into broader categories: (1) software (reference industry); (2) biotech, pharmaceutical, nanotech, energy and other R&D; (3) ICT-manufacturing and robotics; and (4) telecommunications, internet and web publishing. Country dummies were added to control for potential country-specific variation in the value added that the first lead investor contributes to the portfolio firms.

Applying Eq. (1) to a construct of total value added does not yield any significant results. The relationship between GVC and total value added is, again, negative but not significant. The results in Table 3 provide a description of the relationship between investor type and value added outcomes. The table reports the regression results for 8 categories of VAC, including a fixed set of control variables (industries and countries). The first

Table 3

OLS regression results on the relationship between VC type and value-adding contributions controlling for industries and countries.

OLS	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
Sample of IVC- and GVC-supported firms	Strategy	Technology	Market position	Professionalisation	Financial function	Quality	Internationalisation	Exit orientation
Dependent variable: Importance of VC								
Investor: Lead investor is GVC firm	−0.55	−0.40	−0.58	−0.97**	−0.09	−0.40	−0.11	−0.78*
Industry: Bio, pharma, nano, energy and other R&D	−0.36	0.04	0.19	−0.16	−0.07	−0.46	−0.36	−0.40
Industry: ICT manufacturing and robotics	−0.79*	−0.61	−1.25***	−0.81*	−0.92*	−0.90**	−0.60	−0.54
Industry: Telecom, internet and web publishing	−0.96*	−0.30	−0.09	−0.28	−0.88	−0.27	−0.96**	−0.76
Country: Belgium	−0.61	−0.12	0.87	0.05	−0.92	−0.57	−0.52	0.45
Country: Finland	0.34	−0.70*	−0.02	−0.32	0.04	0.43	−0.59	−0.79
Country: France	−1.14**	−0.94**	−1.21**	−1.12**	−0.99*	−0.47	−0.59	−0.38
Country: Germany	0.20	0.81	1.07	0.19	1.46**	0.84	−0.90	1.53**
Constant	4.44***	3.46***	3.87***	4.49***	4.39***	4.19***	2.91***	3.48***
Observations	88	88	88	88	86	84	83	83
F-test (Model)	1.44	1.60	2.91***	1.68	1.53	1.29	0.96	2.06*
R-square	0.13	0.14	0.23	0.15	0.14	0.12	0.09	0.18
Adj. R-square	0.04	0.05	0.15	0.06	0.05	0.03	0.00	0.09

Note: The table tabulates OLS coefficients and significances. Each of the eight columns considers the relationship between having a government VC as a lead investor and the value added contribution of the lead investor in a specific field, controlling for broad industries and countries. Software is the reference industry, and Spain is the reference country.

* Statistical significance: $p < 0.10$.

** Statistical significance: $p < 0.05$.

*** Statistical significance: $p < 0.01$.

Table 4

Comparing the adverse effects of GVC firms and IVC firms on their portfolio firms.

	Full sub-sample			GVCfirm		IVCfirm		Significance		
	Obs	Mean	S.D.	Obs	Mean	Obs	Mean	WMT ^b	WRT ^c	TTT ^d
IP issues	86	1.47	0.128	21	1.24	65	1.54			
Business strategies	86	2.37	0.186	21	2.19	65	2.43	**		
Internationalisation efforts	86	1.77	0.151	21	1.62	65	1.82			
Interaction with venture capitalist	86	2.62	0.201	21	2.10	65	2.78			
Total adverse effects of lead investor ^a	86	2.06	0.141	21	1.79	65	2.14		*	

^a Respondents answered questions about four different forms of adverse effects on a scale from 1 (no negative effects at all) to 7 (very serious effects). The last row in the table represents the total adverse effects, defined as the average of the 4 detailed forms of adverse effects. The last three columns list the significance levels of three different tests.

^b WMT refers to Wilcoxon-Mann-Whitney median test.

^c WRT refers to Wilcoxon-Mann-Whitney ranksum test.

^d TTT refers to two-tailed t-tests in means without assuming equal variances across the groups.

* $p < 0.10$.

** $p < 0.05$.

significant finding of the regression shows that the partial correlation between the GVC indicator and the professionalisation scores is negative and statistically significant (specification d). The second significant finding shows a negative partial correlation between the GVC indicator and exit orientation scores (specification h). The results are in line with the univariate results presented in Table 2. For other categories of value added, the OLS coefficients of the GVC indicator were only weakly or not at all significant.

In addition to industry and country information, we added firm-level information to capture potential differences among investor types in their selection of investee firms. Including the measures described above, that is, founder experience, firm size, firm stage, R&D intensity and profits, weakens the significance of the results somewhat. Nevertheless, the significant negative partial correlation between the GVC indicator and both professionalisation and exit orientation scores is robust.

To summarise, in a multivariate context, most of the differences between the two investor types, first observed in a univariate context, are confirmed. IVC firms generally give more support than GVC firms in professionalisation (e.g., changing the management team and finding board members) and exit orientation (e.g., finding acquirers for a trade sale). In addition, IVC firms are more important for accelerating growth pressure. The results of the multivariate analysis also revealed that IVC firms are more important than GVC firms in providing credibility to investors (see Table A1). Regarding our hypotheses, we conclude that there was support for our second hypothesis: the government and independent venture capitalists had somewhat different strengths in their value added activities, thus evidencing different profiles in their activities and the impacts these had. Regarding hypothesis 1, because the total value added contribution is not significantly different between the VC types, the hypothesis has to be rejected.

4.3. Adverse effects on the investee of government VC firms versus independent VC firms

4.3.1. Comparing adverse effects

As noted, the activities of the lead investors may cause friction and adverse effects in their portfolio firms. These activities can be related to an active approach by the investor because his/her stance might conflict with that of the firm's management, especially if the activities are related to recruitment for the management team. It is also possible that the expectations by the portfolio firm's management vis-à-vis the investor in terms of help, active input and other aspects may be disappointed and cause friction.

Adverse effects were explored by the survey and referred to problems, tensions or pressures, or ill-advised choices. Investees were asked whether the first lead investor had adverse effects in four areas: (1) intellectual property rights; (2) business strategies; (3) internationalisation efforts and (4) time spent interacting with the venture capitalist. The adverse effects questions were based on a scale from 1 (no negative effects at all) to 7 (very serious effects). The results are given in Table 4.

Overall, the ratings for adverse effects were quite low, indicating that the investee firms had not suffered from these effects a great deal. On average, all four categories of adverse effects had lower scores for GVC firms than for IVC firms, although the differences were only very weakly significant. The results of the non-parametric tests are in line with the above findings but also find differences of some significance (at the $p < 0.05$ level) in business strategies. Furthermore, the overall degree of value added contributions and a composite index of adverse effects did not correlate with each other.

On the basis of the findings, we cannot conclude that there were differences between the two investor types in their propensities to have adverse effects on the investee firm or that the value added contributions would have been strongly correlated with the extent of adverse effects.

4.3.2. Comparing adverse effects while controlling for firm characteristics

The final step in our analysis focuses on the relationship between VC type and the adverse effects of VCs in a multivariate context. The econometric setup used is based on Eq. (1), where the dependent variable is now the adverse effect score. Once again, results have to be interpreted as partial correlations rather than causation.

The first regression analysis we performed explains the total value added as a function of VC type (a GVC dummy) and a set of industry and country dummies. Table 5 tabulates its results and shows that the relationship between VC type and adverse effects were not significant.

To summarise, we found that GVC firms had somewhat fewer adverse effects than IVC firms, but only in one dimension, that is, business strategies. This finding lends weak support to assumptions that less intensive post-investment involvement in the portfolio firm causes less friction and fewer problems in the interaction.

5. Summary and concluding remarks

In this paper we aimed to discover whether government and independent venture capitalist firms differed in their value-adding behaviours as assessed by their investee firms, that is, in the 'treatment' they offer to their investee firms, while controlling for the 'selection' effect. The study used a unique data set based on a survey addressed to new, VC-backed, high-tech companies in

Table 5

OLS regression results on the relationship between VC type and adverse effects, controlling for industries and countries.

OLS	Coeff.	Signif.
Sample of IVC- and GVC-supported firms		
Dependent variable: Adverse effects of lead investor		
Investor: Lead investor is Government VC	-0.536	
Industry: Bio, pharma, nano, energy, other R&D	0.515	
Industry: ICT manufacturing and robotics	-0.128	
Industry: Telecom, internet and web publishing	-0.262	
Country: Belgium	-0.267	
Country: Finland	0.103	
Country: France	-0.699	
Country: Germany	0.503	
Constant	2.273	***
Observations	86	
F-test(Model)	1.082	
R-square	0.101	
Adj. R-square	0.008	

Note: The table tabulates OLS coefficients and significances. The table presents the relationship between having a government VC as a lead investor and the total adverse effect of the lead investor on its portfolio firms, while controlling for broad industries and countries. Software is the reference industry, and Spain is the reference country.

*** $p < 0.01$ statistical significance.

seven European countries. The study focused on the importance of the value added by the first lead investors as assessed by the investee companies. Our contribution to the research literature is the focus on two important types of VC that have been thought to have widely different investment motivations, preferences, human capital and investment horizons. Another contribution concerns the exploration of the adverse effects that the involvement of venture capitalists in their investee firms might cause.

We first investigated whether the two investor types differed in their investment profiles to be able to control for the potential selection effect. The investors differed in a number of respects, and these findings were used as controls in subsequent analysis. The value-adding activities were analysed in univariate and multivariate contexts using variables indicating portfolio selection. In a multivariate context, most differences between the two investor types, first observed in a univariate context, were supported. IVC firms were more important in professionalisation, activities such as changing the management team and finding board members and exit orientation (finding acquirers for a trade sale). Although the overall value-adding behaviours of the two investor types did not differ—using a composite indicator for value-adding activities—at a statistically significant level, we concluded that IVC firms performed better in a few activities of importance for the business of the firm. We thus found some support for our second hypothesis, namely, that the profiles of the value added activities of the two investor types differed. However, we did not find support for our first hypothesis that, on average, the importance of the value-adding contributions of government venture capitalists was less than those of independent venture capitalists.

It was assumed that the activities of the lead investor might have caused friction and adverse effects in the company. However, the study showed that, overall, such effects were minor. There was also little difference between the two investor types in terms of these adverse effects. The differences in the value added by government and independent VC firms were smaller than we had expected. On average, we did not obtain findings supporting the view that GVCs provided less value added to their portfolio

firms (Knockaert et al., 2006; Knockaert and Vanacker, forthcoming). However, the superior role of the independent venture capitalists in specific actions, such as professionalisation, concurs with several previous studies (Ehrlich et al., 1994; Maula et al., 2005).

This study was based on survey data. We did not use in-depth data that can be obtained through interviews because, in general, the activities and functions of VC investors in portfolio firms have been extensively studied in the literature. Our contribution lies in testing the differences in investment behaviour between two important investor groups, one of which is under-researched, and for such a purpose, survey-based data provide an appropriate source. However, it is interesting to compare our findings with those obtained in other studies based on the VICO database that compared GVC with IVC or other forms of VC. Bertoni and Tykvová (2012) compared the innovative output (in terms of patents) of biotech and pharmaceutical companies backed by GVC with that of firms backed by private VC investors (including IVC and other private 'captive' VC investors). These authors found that firms backed by private VC investors markedly outperformed firms backed by GVC investors. Grilli and Murtinu (2011) further found that in terms of the growth (sales, employees, total assets) of portfolio companies, on average, those backed by private VC firms outperformed those backed by public VC firms. GVC investors did not have any impact on growth except in the case of young ventures in their earliest stages. Overall, Bertoni and Tykvová (2012) and Grilli and Murtinu (2011) highlight that GVC investors have less impact on portfolio firm performance than private VC investors. Compared with these studies our research did not lend strong evidence of the average value-adding differences between

GVC and IVC investors, though it provided some evidence of the different profiles in the value-adding behaviour of the two investor types. Such differences may contribute to the differences in the performance of the portfolio firms. These studies thus focused on slightly different aspects of the phenomenon. Finally, Bertoni and Tykvová (2012) and Grilli and Murtinu (2011) show that GVC and IVC investors could have a complementary effect, as suggested in the literature on other forms of VC (Maula et al., 2005). However, our study could not provide evidence of this complementarity because we could not study the complementarity of the behaviour of venture capitalists in the same syndicate due to the focus of the analysed survey data on the lead investors. Furthermore, most of the firms included in our data did not have syndicates, and we were thus able to study only the influence of the lead (or only) investor. Thus, the performance differences between the two investor types we studied do not convey any information regarding whether another investor filled the roles and functions that were determined to be less important in the behaviour of the lead investor.

The question of the role and contribution of GVC investors still begs further analysis with larger and more robust data sets in different national contexts. The question of the relative performance of GVC in direct investments as opposed to their role as funds of funds—both roles being common—also needs studies which combine quantitative with qualitative methods.

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Table A1

OLS regression results on the relationship between VC type and 28 forms of value-adding contributions, controlling for firm characteristics, industries and countries.

Category	Form of value added	GVC	R ²	Adj R ²	F-test	Obs
Strategy	Business plan	−0.67	0.13	−0.02	0.85	88
	Strategic focus	−0.46	0.15	0.01	1.03	88
	Capabilities	−0.24	0.15	0.01	1.04	88
Technol. position	R&D function improvement	0.10	0.23	0.10	1.73*	88
	Strong legal IP base	−0.01	0.20	0.06	1.40	88
	Partnerships for tech. dev.	−0.47	0.26	0.13	1.97**	88
Market position	Sales and marketing position	0.04	0.22	0.08	1.56	88
	First sales pressure	−0.35	0.24	0.11	1.83*	88
	Accelerate growth pressure	−0.90*	0.29	0.17	2.36**	88
Professionalisation	Cost base control	−0.61	0.19	0.05	1.32	88
	Corporate gov. systems	−0.69	0.16	0.01	1.07	88
	Change in management team	−1.00*	0.21	0.08	1.54	88
	Finding board members	−0.96*	0.21	0.07	1.49	88
Financial function	Obtaining non-equity finance	0.11	0.18	0.03	1.18	86
	Raising follow-on financing	0.09	0.14	−0.01	0.92	87
	Attracting new VC investors	−0.14	0.17	0.02	1.12	87
Quality	Credib. for other investors	−0.82*	0.21	0.06	1.41	85
	Credib. for customers	0.00	0.17	0.03	1.17	86
	Credib. for suppl. and partners	−0.27	0.11	−0.05	0.69	85
	Credib. for recruit. employees	−0.34	0.21	0.07	1.50	86
Internationalisation ^a	Marketing and distribution	0.47	0.11	−0.06	0.66	85
	Equity financing	−0.22	0.15	0.00	0.98	85
	Management team	−0.15	0.20	0.06	1.40	85
	Other staff	−0.22	0.23	0.09	1.63*	86
	Board members	−0.38	0.18	0.03	1.17	84
Exit orientation	Prepare IPO	−0.41	0.13	−0.03	0.83	83
	Finding trade sale acquirers	−1.20**	0.20	0.05	1.31	84
	Prepare for other exit routes	−1.00*	0.23	0.09	1.64*	84

Note: The table tabulates OLS coefficients and significances. Each of the 28 rows considers the relationship between having a government VC as a lead investor and the value added contribution of the lead investor in a specific field (business plan, strategic focus, etc.), controlling for founder experience, firm size, firm stage, R&D intensity, profits, broad industries and countries. Software is the reference industry, and Spain is the reference country.

^a Forms of value added under the category internationalisation refer to sourcing different forms of inputs from abroad.

* $p < 0.10$ statistical significance.

** $p < 0.05$ statistical significance.

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Appendix A

See Table A1.

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